00920T-H2886960

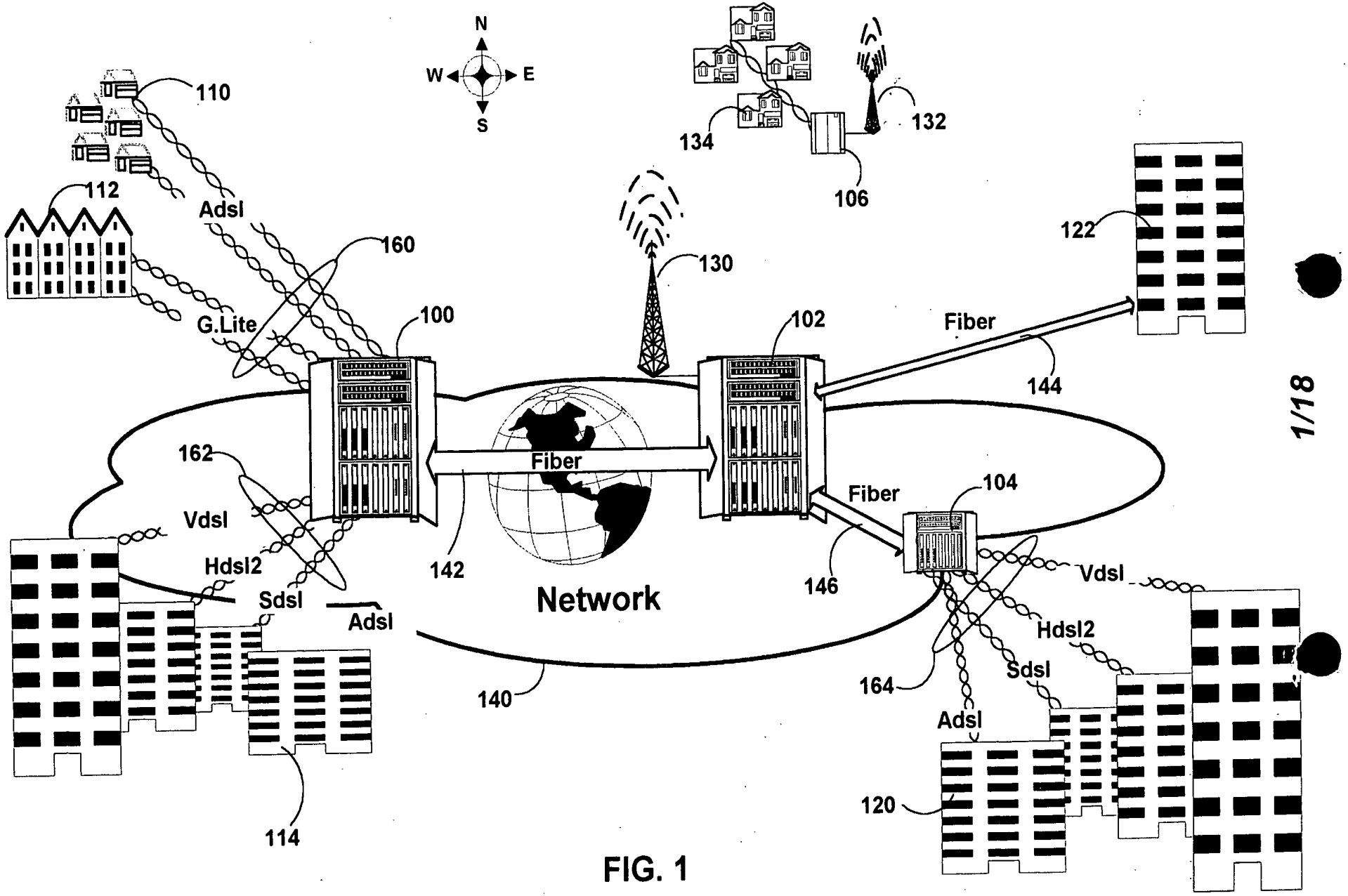
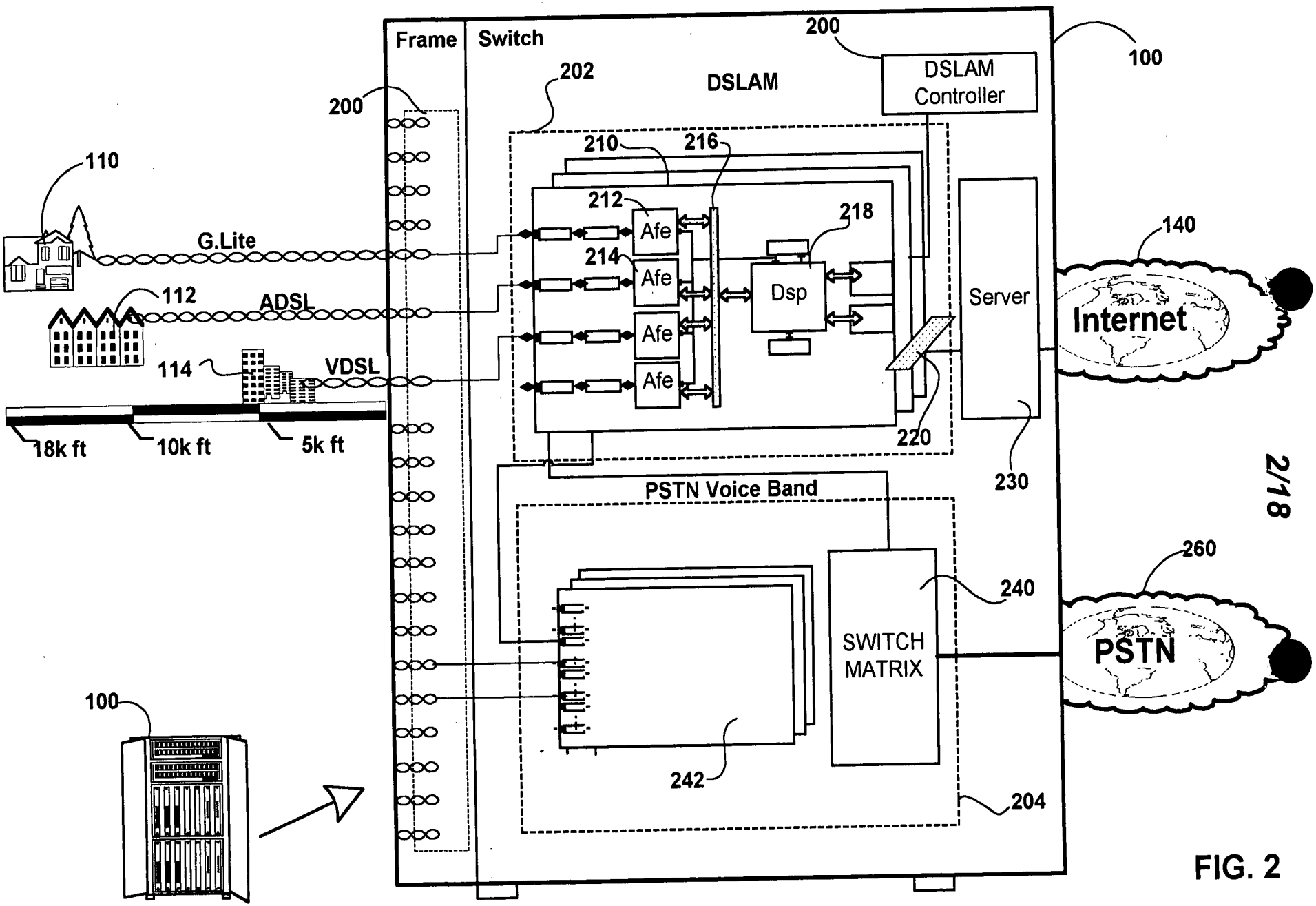


FIG. 1

Packet Based distributed xDSL System


Frame
Switch
200
DSLAM
202
DSLAM Controller
100
200
210
216
212
Afe
214
Afe
Afe
Afe
218
Dsp
Server
140
Internet
110
G.Lite
112
ADSL
114
VDSL
18k ft
10k ft
5k ft
220
230
PSTN Voice Band
260
240
SWITCH MATRIX
PSTN
242
204
100

2/18

FIG. 2

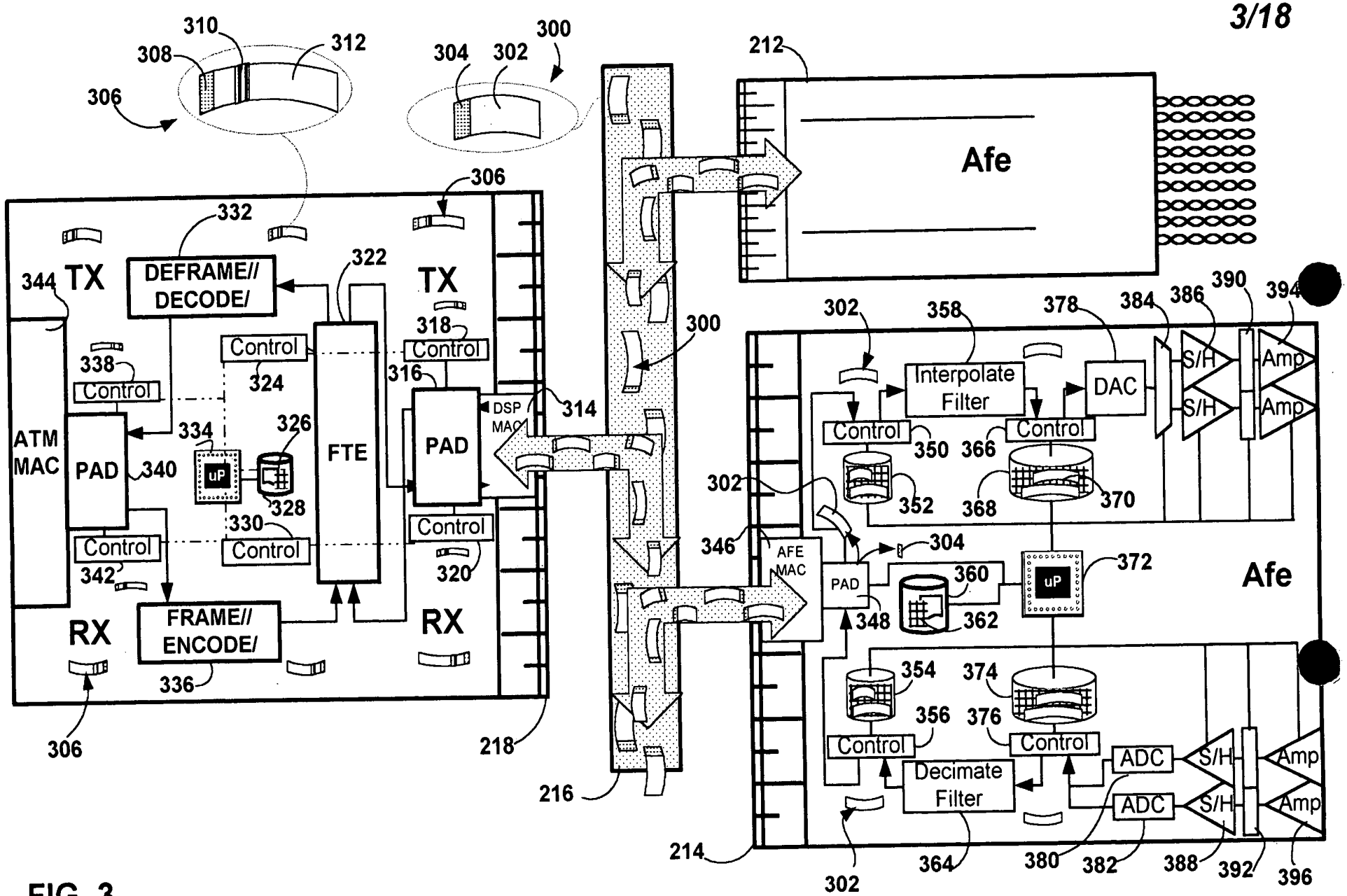

310
308
312
306
304
302
300
212
Afe
306
332
322
344
TX
DEFRAME// DECODE/
TX
318
Control
338
Control
324
316
300
ATM MAC
PAD
340
334
326
uP
328
FTE
PAD
DSP MAC
314
330
Control
Control
Control
342
320
RX
FRAME// ENCODE/
RX
336
306
218
216
214
302
358
378
384
386
390
394
Interpolate Filter
DAC
S/H
S/H
Amp
Amp
Control
350
366
Control
302
352
368
370
346
AFE MAC
304
PAD
360
372
uP
Afe
348
362
354
374
356
376
Control
Control
Decimate Filter
ADC
ADC
S/H
S/H
Amp
Amp
364
380
382
388
392
396

FIG. 3

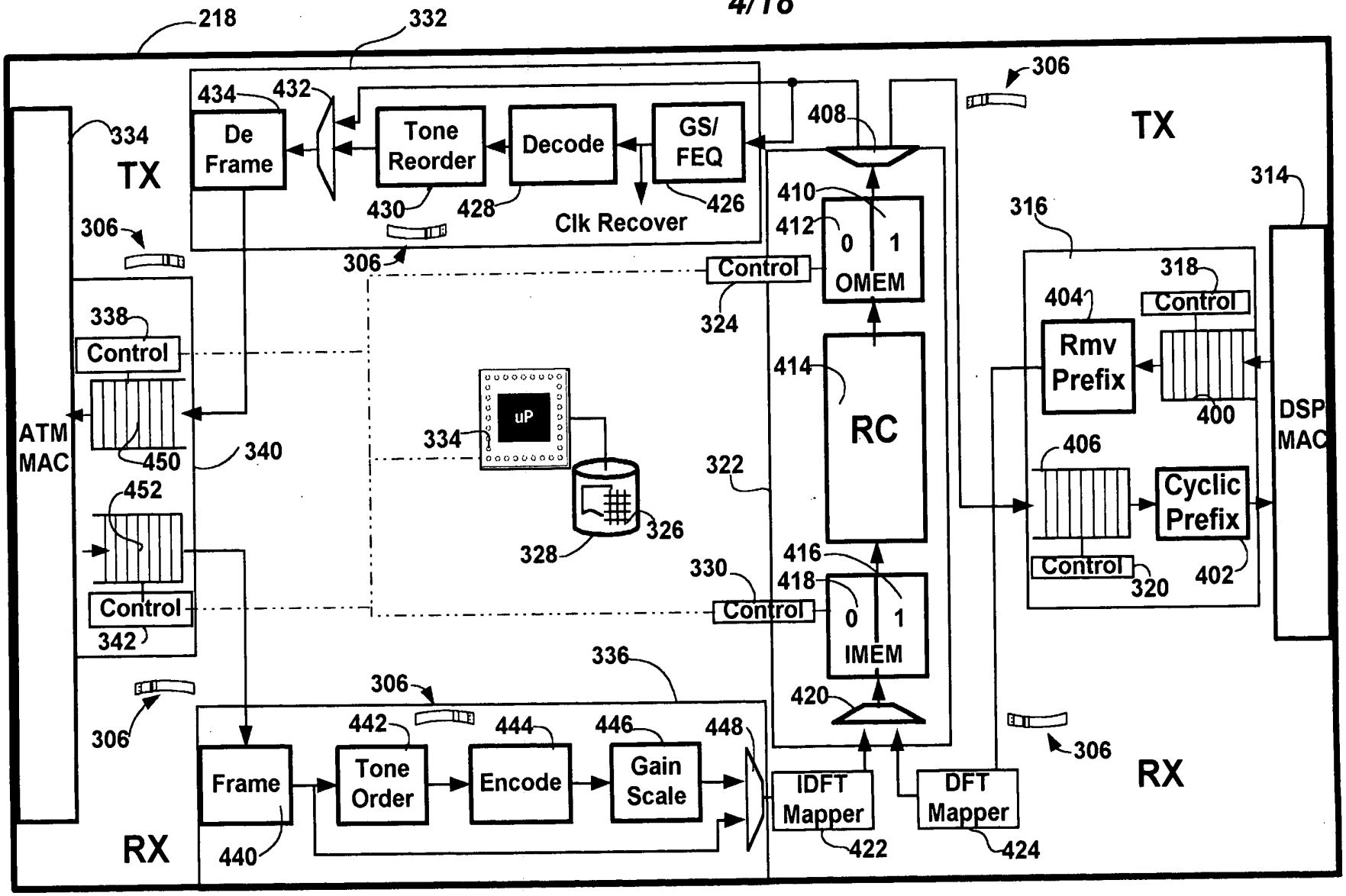
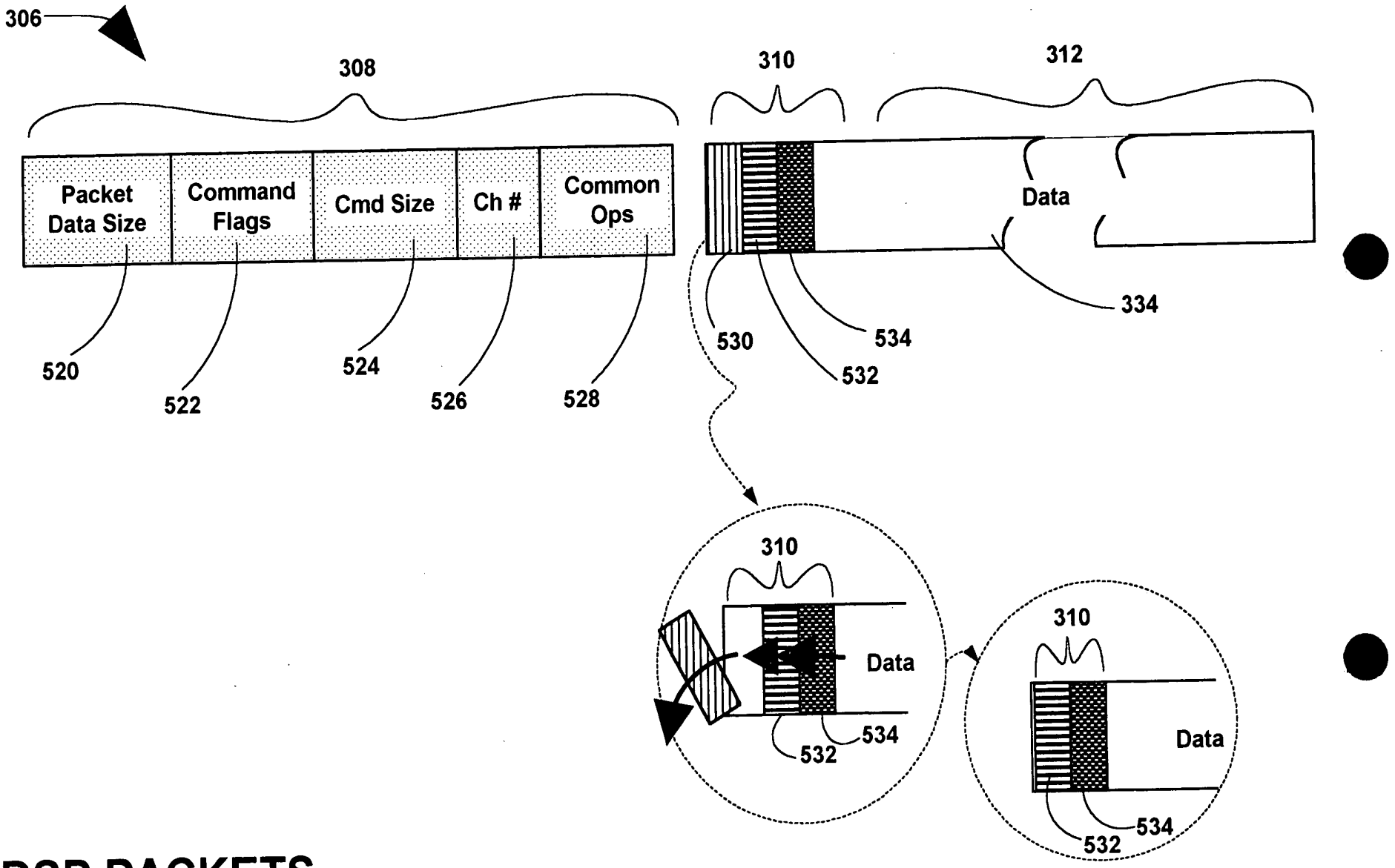

218
332
306
TX
334
De Frame
434
432
Tone Reorder
Decode
GS/ FEQ
430
428
426
Clk Recover
408
410
412
0
1
OMEM
Control
324
306
338
Control
ATM MAC
450
340
452
Control
342
uP
334
328
326
414
RC
322
416
418
IMEM
330
Control
420
316
318
Control
404
Rmv Prefix
400
406
Cyclic Prefix
Control
320
402
314
DSP MAC
336
306
442
444
446
448
Frame
Tone Order
Encode
Gain Scale
440
RX
IDFT Mapper
422
DFT Mapper
424
306
RX

FIG. 4



DSP PACKETS

FIG. 5

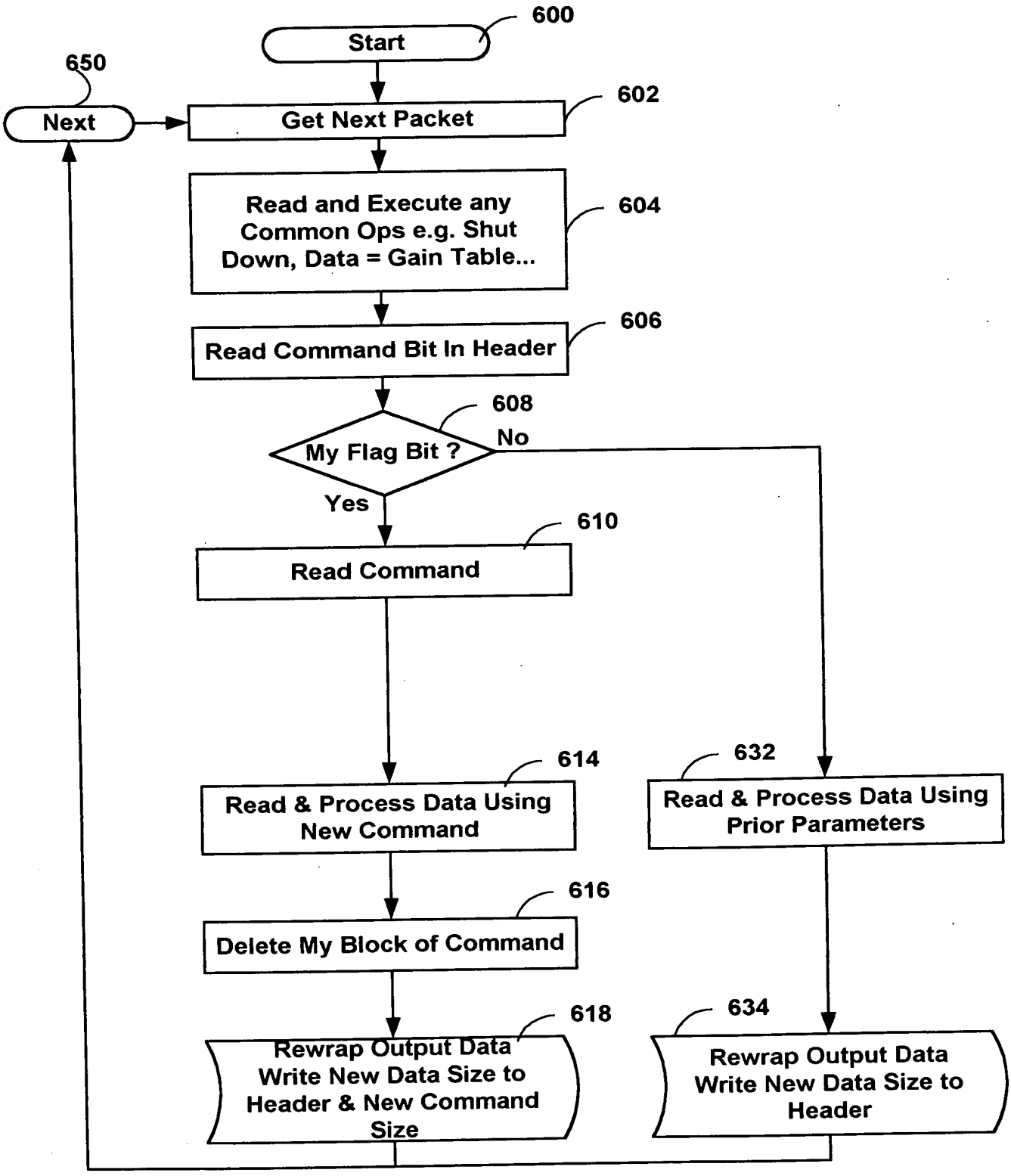
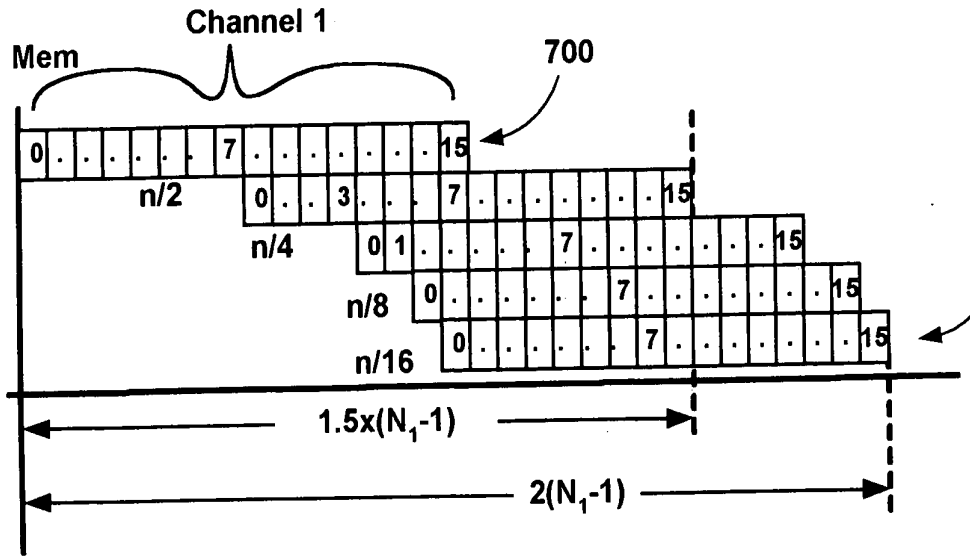

600
Start
650
Next
602
Get Next Packet
Read and Execute any Common Ops e.g. Shut Down, Data = Gain Table...
604
Read Command Bit In Header
606
608
My Flag Bit ?
No
Yes
610
Read Command
614
Read & Process Data Using New Command
632
Read & Process Data Using Prior Parameters
616
Delete My Block of Command
618
Rewrap Output Data Write New Data Size to Header & New Command Size
634
Rewrap Output Data Write New Data Size to Header

FIG. 6



PRIOR ART

FIG. 7

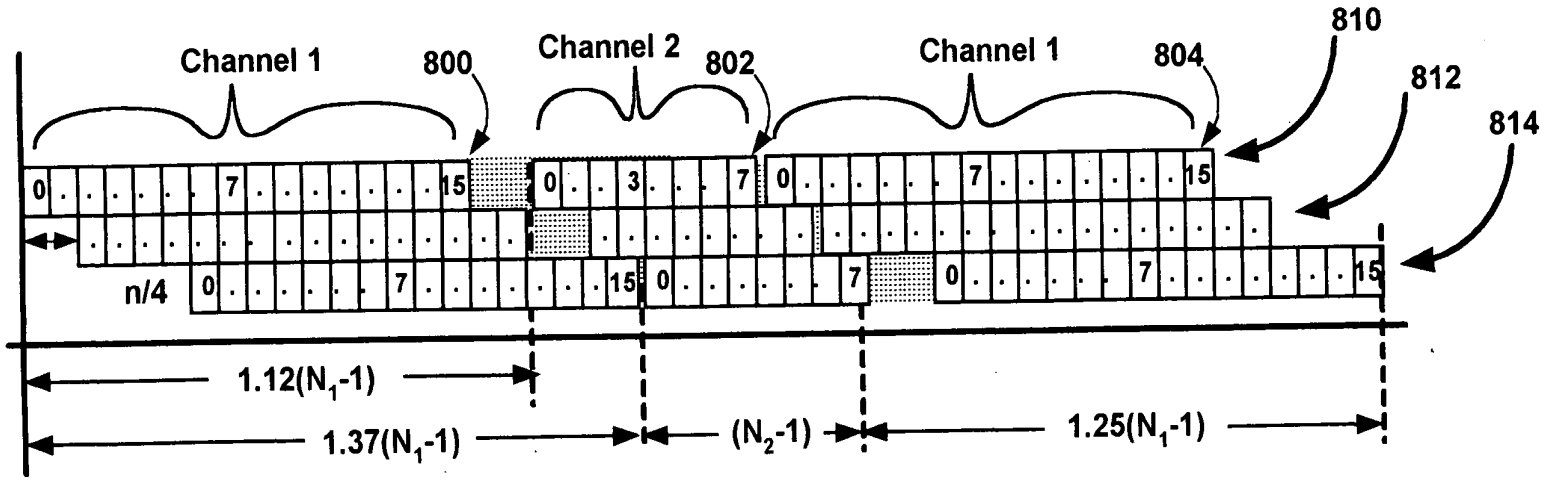
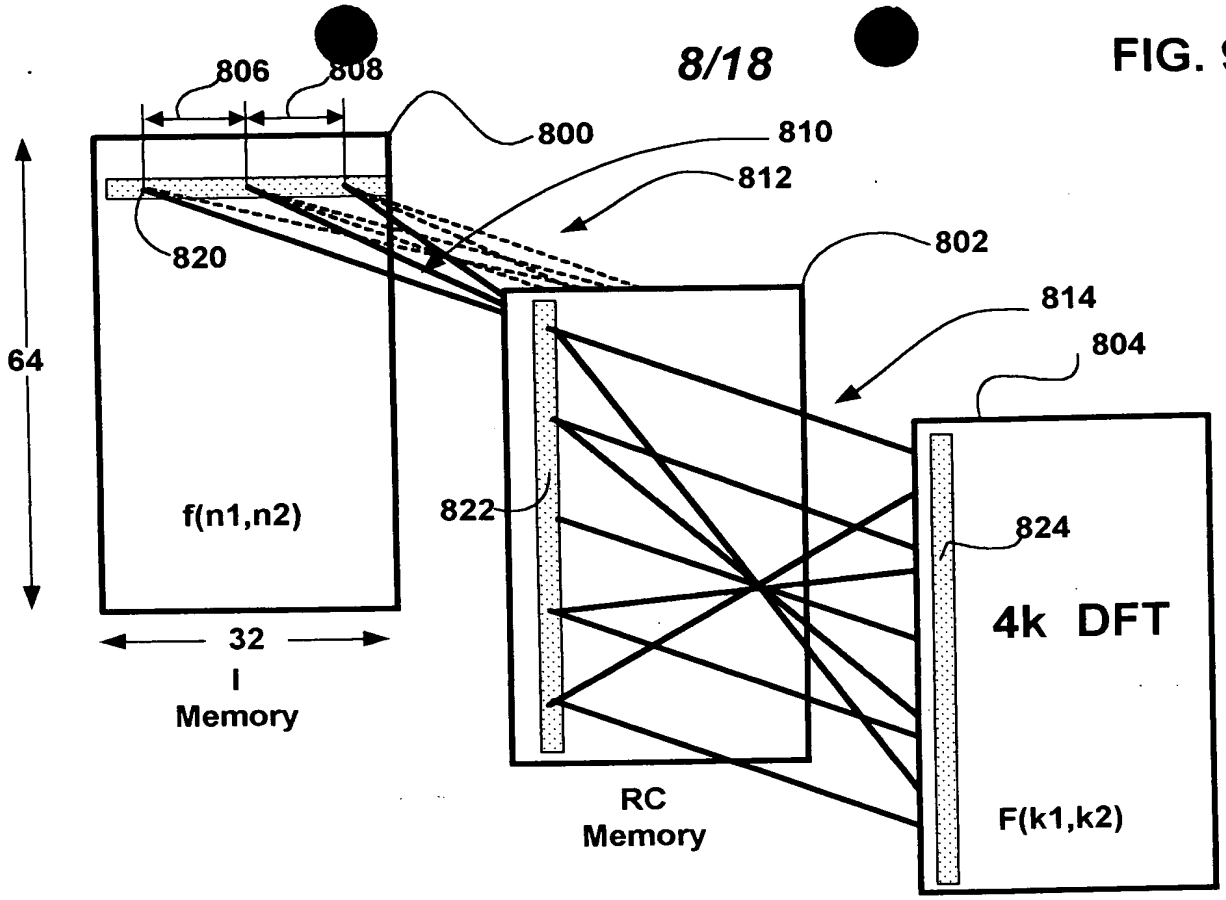


FIG. 8

FIG. 9A


806
808
800
810
812
820
802
814
804
64
f(n1,n2)
822
824
4k DFT
32
I
Memory
RC
Memory
F(k1,k2)
O
Memory

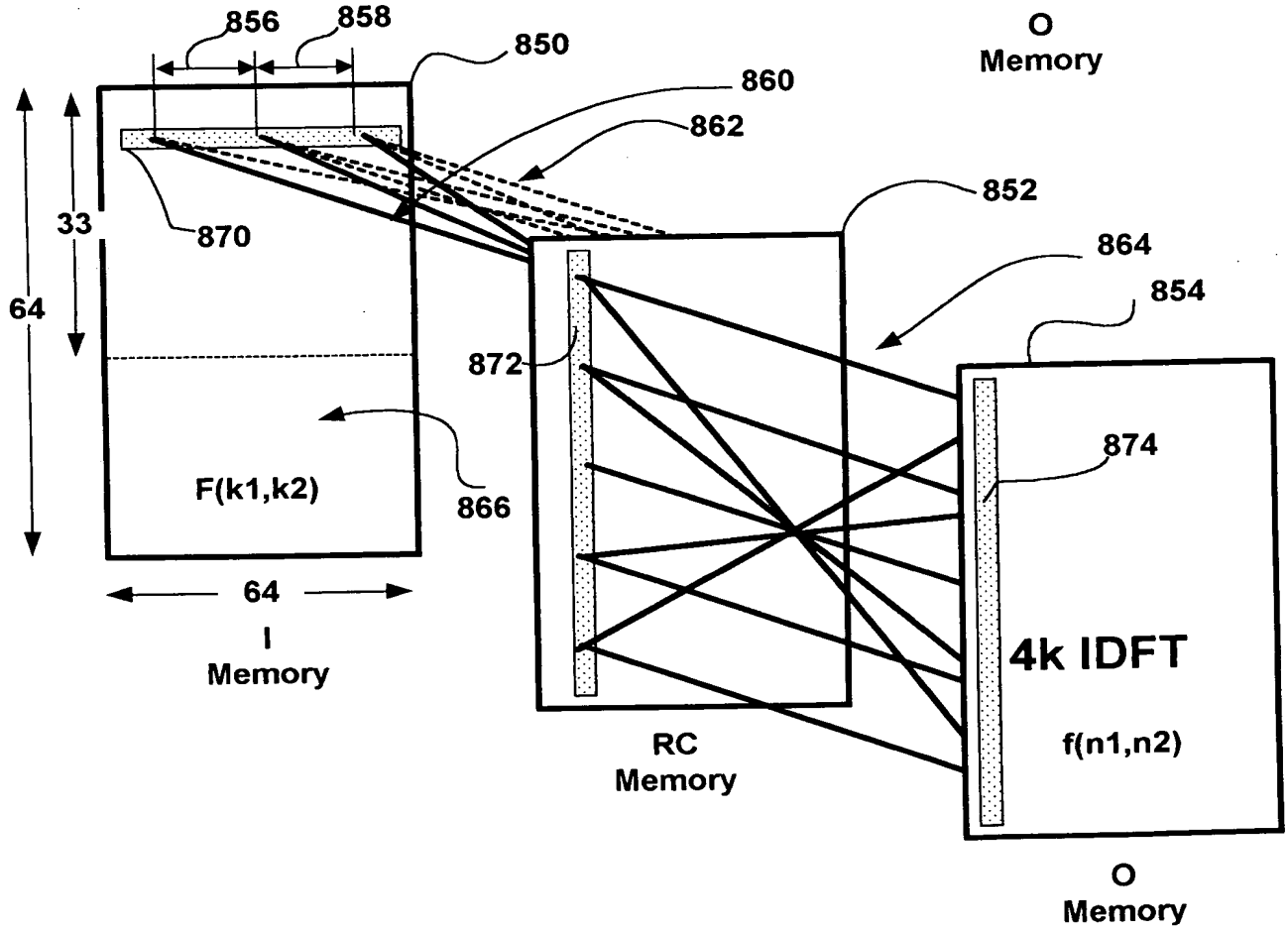

856
858
850
860
862
852
33
870
864
854
64
872
874
F(k1,k2)
866
64
I
Memory
4k IDFT
RC
Memory
f(n1,n2)
O
Memory

FIG. 9B

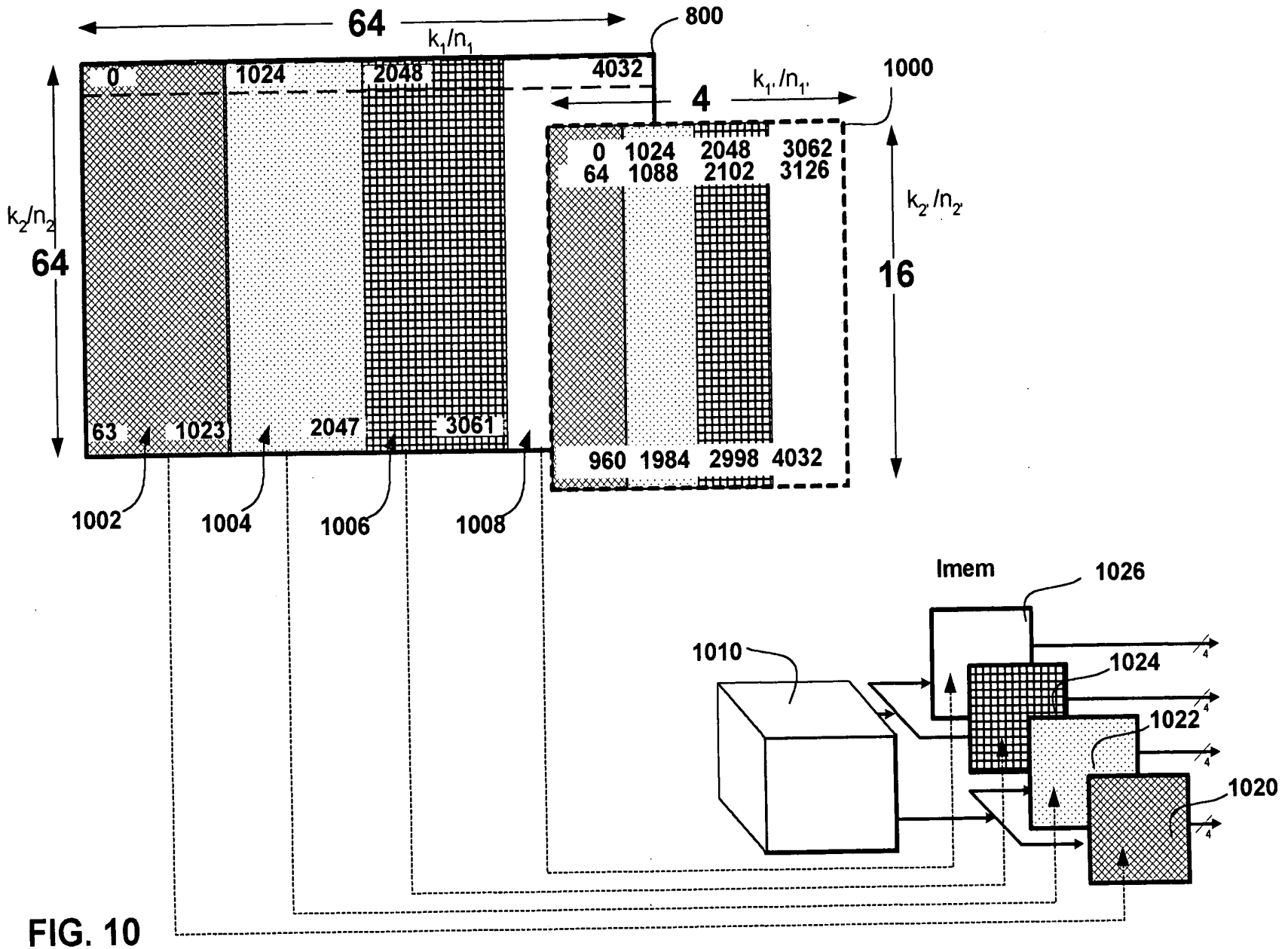

64
k_1/n_1
800
0
1024
2048
4032
4
$k_{1'}/n_{1'}$
1000
0 1024 2048 3062
64 1088 2102 3126
k_2/n_2
64
$k_{2'}/n_{2'}$
16
63
1023
2047
3061
960 1984 2998 4032
1002
1004
1006
1008
Imem
1026
1010
1024
1022
1020
FTE

FIG. 10

TRANSMIT	G.LITE	ADSL	VDSL	Other
Sample space	256	512	512 , 1024, 2048, 4096	
# Tones	128	256	256, 512, 1024, 2048	
Cyclic Prefix	16	32	Programmable	
⋮	⋮	⋮	⋮	⋮
Switching	High Pass Filter	High Pass Filter	None	

FIG. 11A

RECEIVE	G.LITE	ADSL	VDSL	Other
Sample space	64	64	512 , 1024, 2048, 4096	
# Tones	32	32	256, 512, 1024, 2048	
Cyclic Prefix	4	4	Programmable	
⋮	⋮	⋮	⋮	⋮
Switching				

FIG. 11B

FIG. 11C

Sample	ROW TRANSFORM		COLUMN TRANSFORM	
4k	64	16	64	16
2k	32	8	64	16
1k	32	8	32	8
512	16	4	32	8
256	16	4	16	4
128	8	2	16	4
64	64	16	1	1

FIG. 12A

DFT

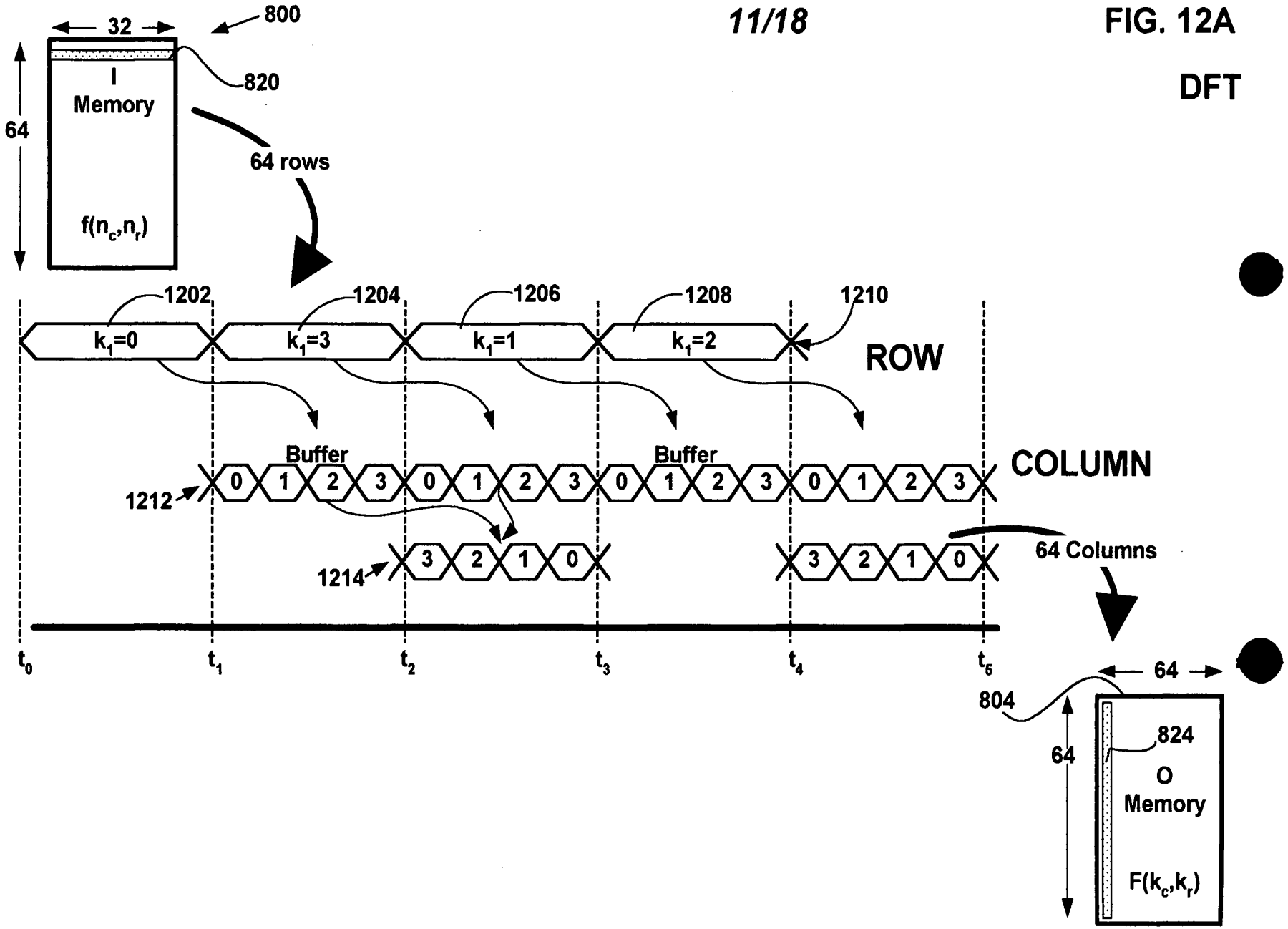
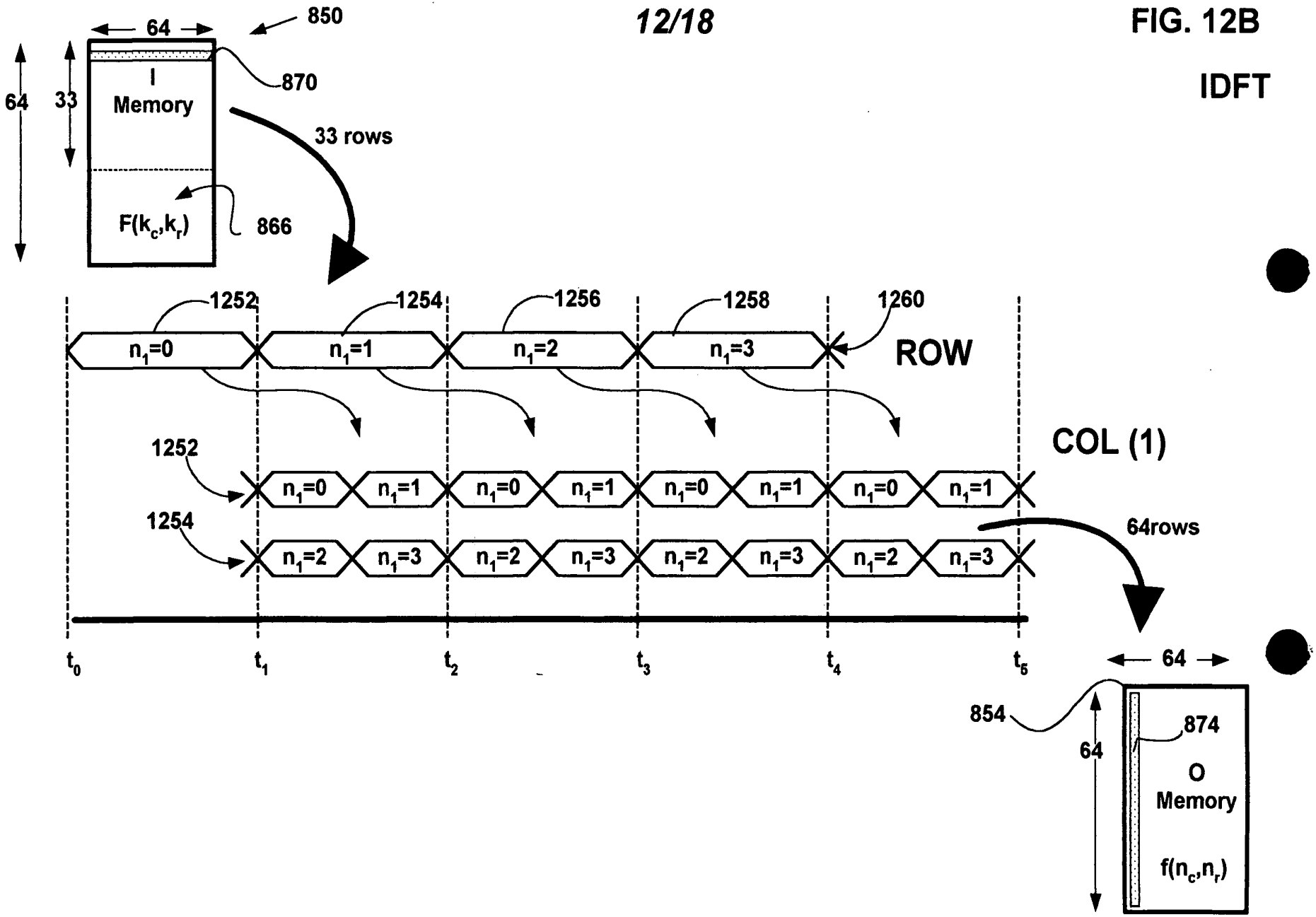

800
32
820
I
Memory
64
64 rows
f(n_c,n_r)
1202
1204
1206
1208
1210
k_1=0
k_1=3
k_1=1
k_1=2
ROW
Buffer
Buffer
COLUMN
1212
0 1 2 3 0 1 2 3 0 1 2 3 0 1 2 3
1214
3 2 1 0
3 2 1 0
64 Columns
t_0
t_1
t_2
t_3
t_4
t_5
64
804
824
64
O
Memory
F(k_c,k_r)

FIG. 12B

IDFT


64
850
64
33
I
Memory
870
33 rows
F(k_c,k_r)
866
1252
1254
1256
1258
1260
n_1=0
n_1=1
n_1=2
n_1=3
ROW
COL (1)
64rows
t_0
t_1
t_2
t_3
t_4
t_5
854
874
O
Memory
f(n_c,n_r)

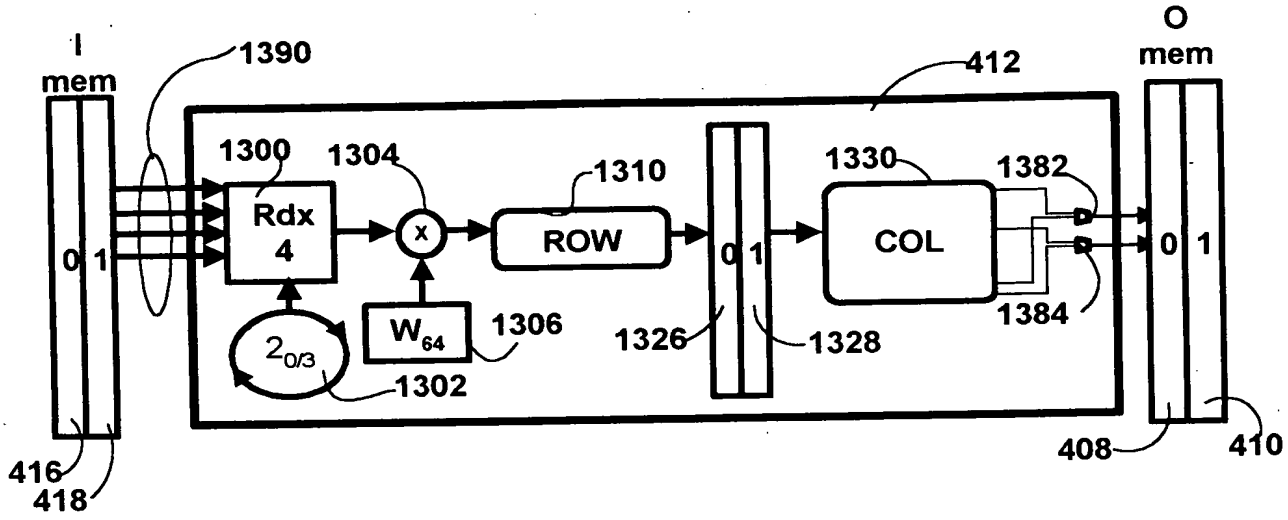


FIG. 13A

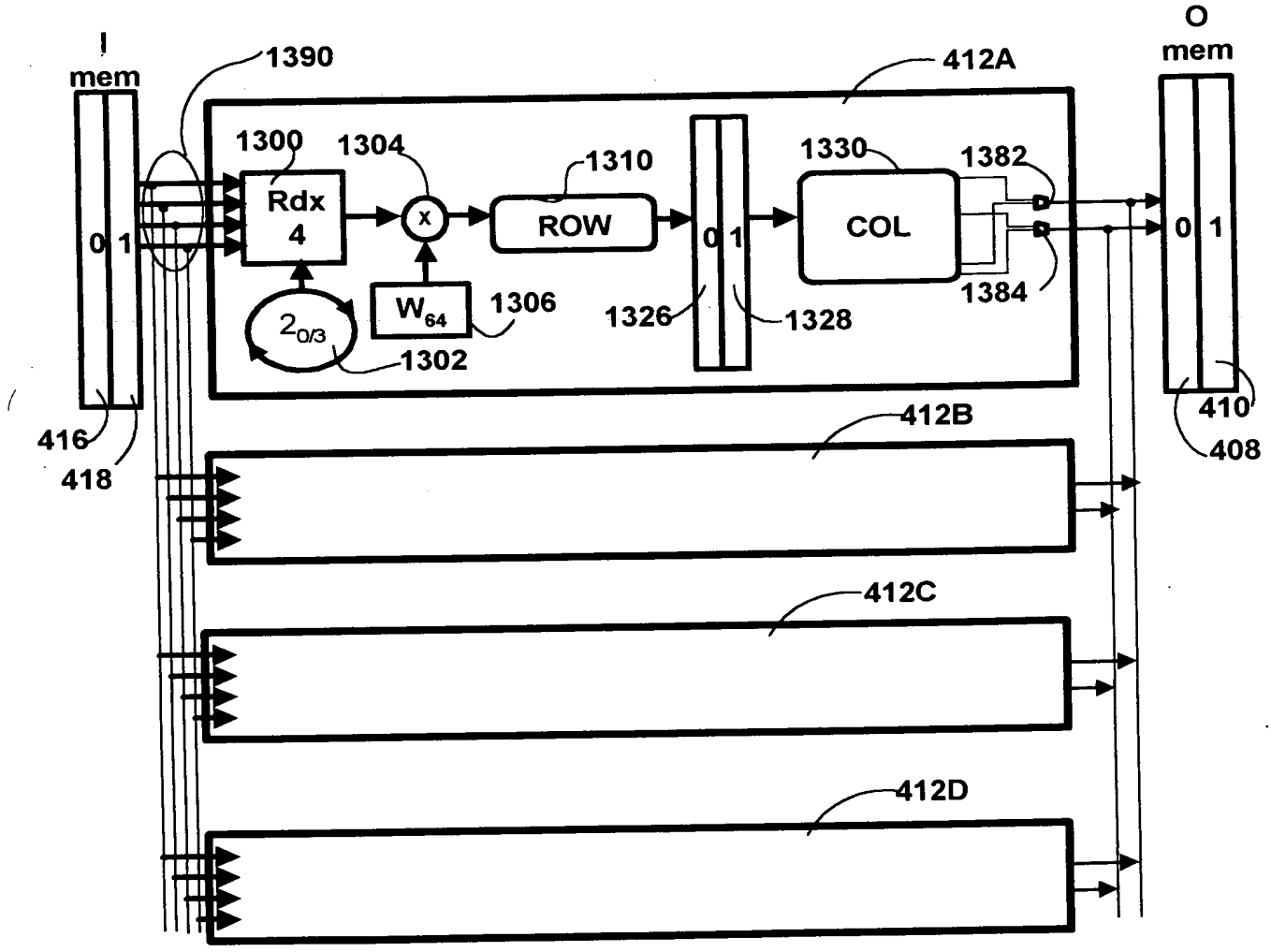
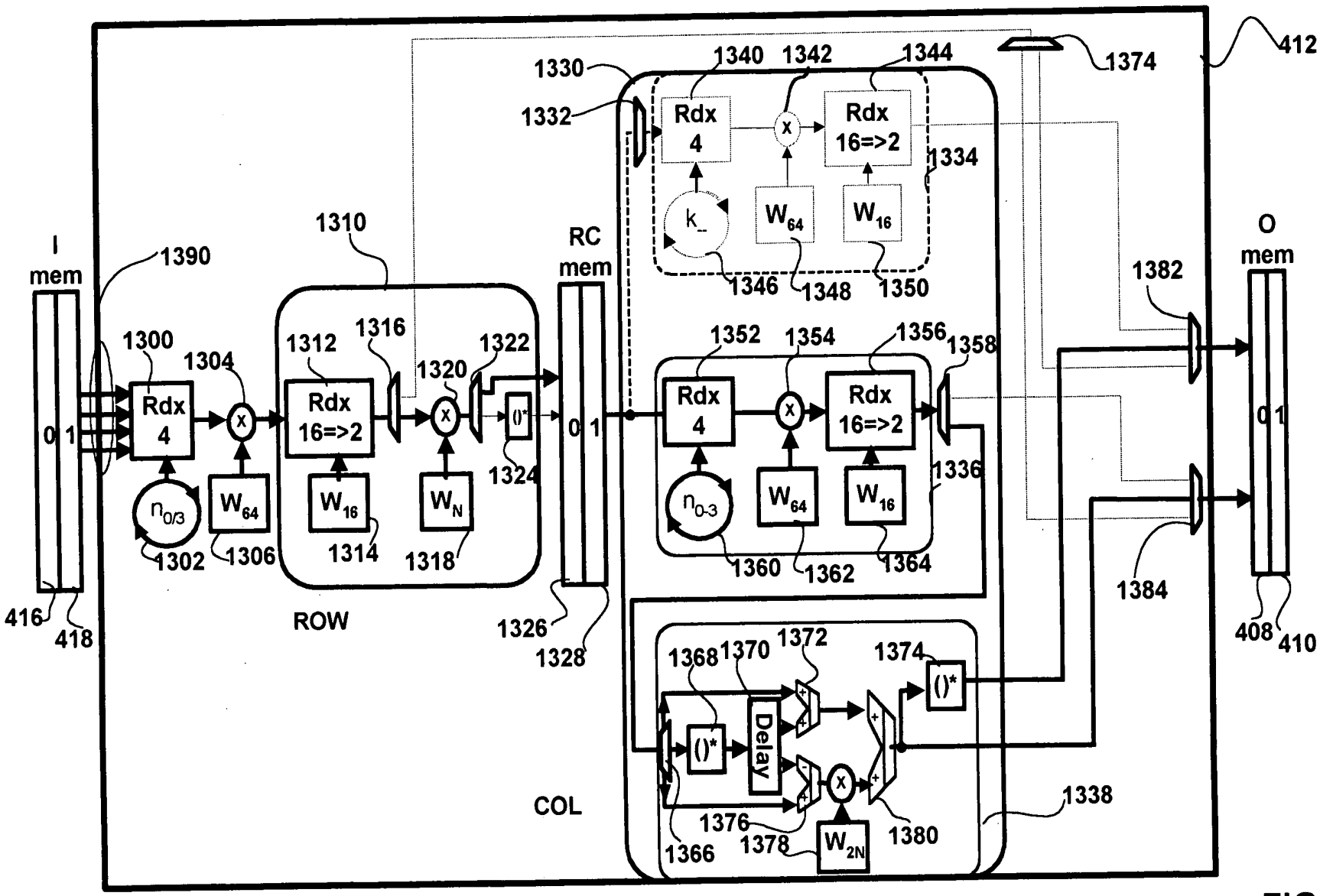


FIG. 13B


I mem
O mem
RC mem
ROW
COL
Rdx 4
Rdx 16=>2
Delay
1300
1302
1304
1306
1310
1312
1314
1316
1318
1320
1322
1324
1326
1328
1330
1332
1334
1336
1338
1340
1342
1344
1346
1348
1350
1352
1354
1356
1358
1360
1362
1364
1366
1368
1370
1372
1374
1376
1378
1380
1382
1384
1390
408
410
412
416
418

DFT

FIG. 13C

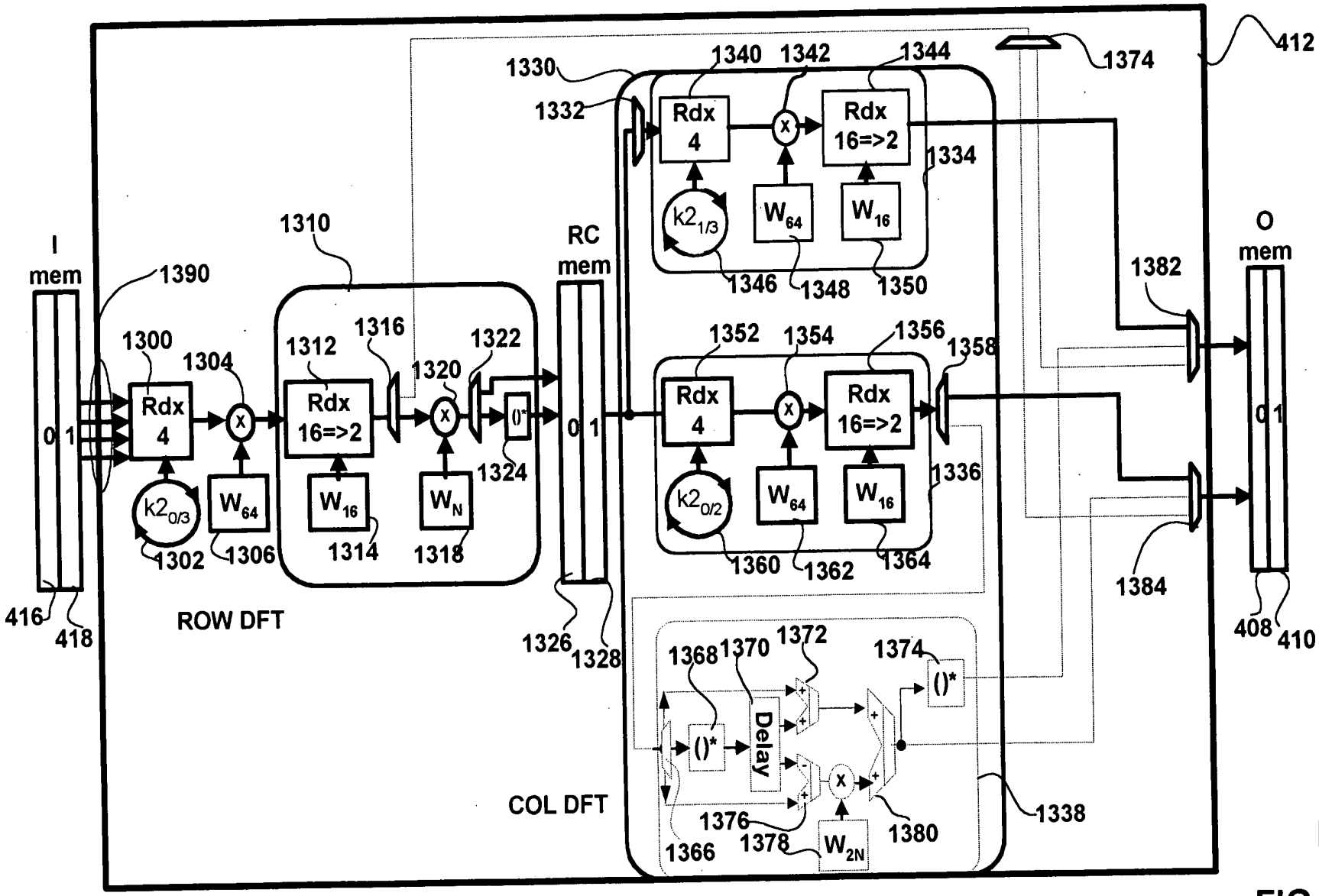

I mem
O mem
RC mem
ROW DFT
COL DFT
IDFT
Rdx 4
Rdx 16=>2
Delay
()*
0 1
1300
1302
1304
1306
1310
1312
1314
1316
1318
1320
1322
1324
1326
1328
1330
1332
1334
1336
1338
1340
1342
1344
1346
1348
1350
1352
1354
1356
1358
1360
1362
1364
1366
1368
1370
1372
1374
1376
1378
1380
1382
1384
1390
408
410
412
416
418
$k2_{0/3}$
$k2_{1/3}$
$k2_{0/2}$
W_{64}
W_{16}
W_N
W_{2N}

FIG. 13D

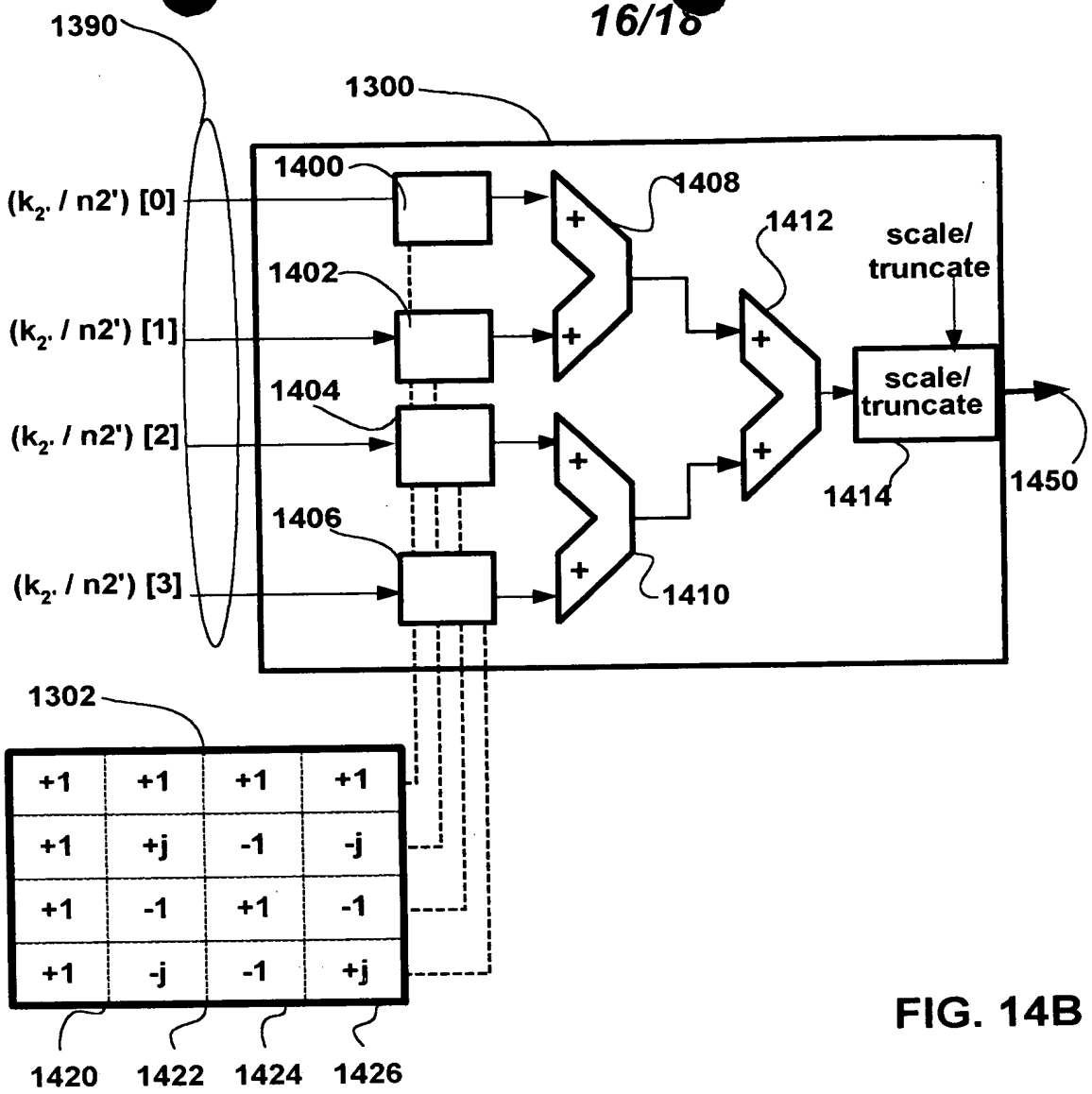


FIG. 14B

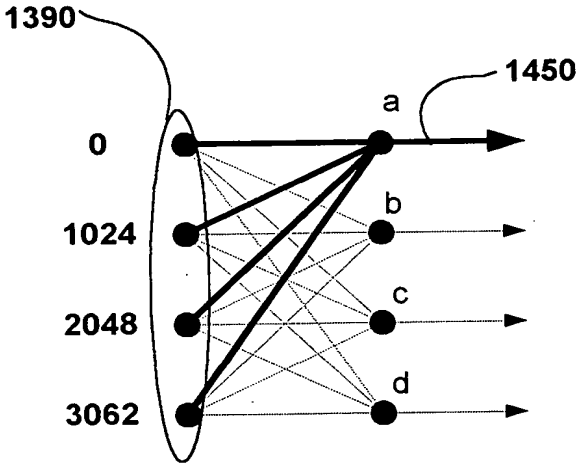


FIG. 14A

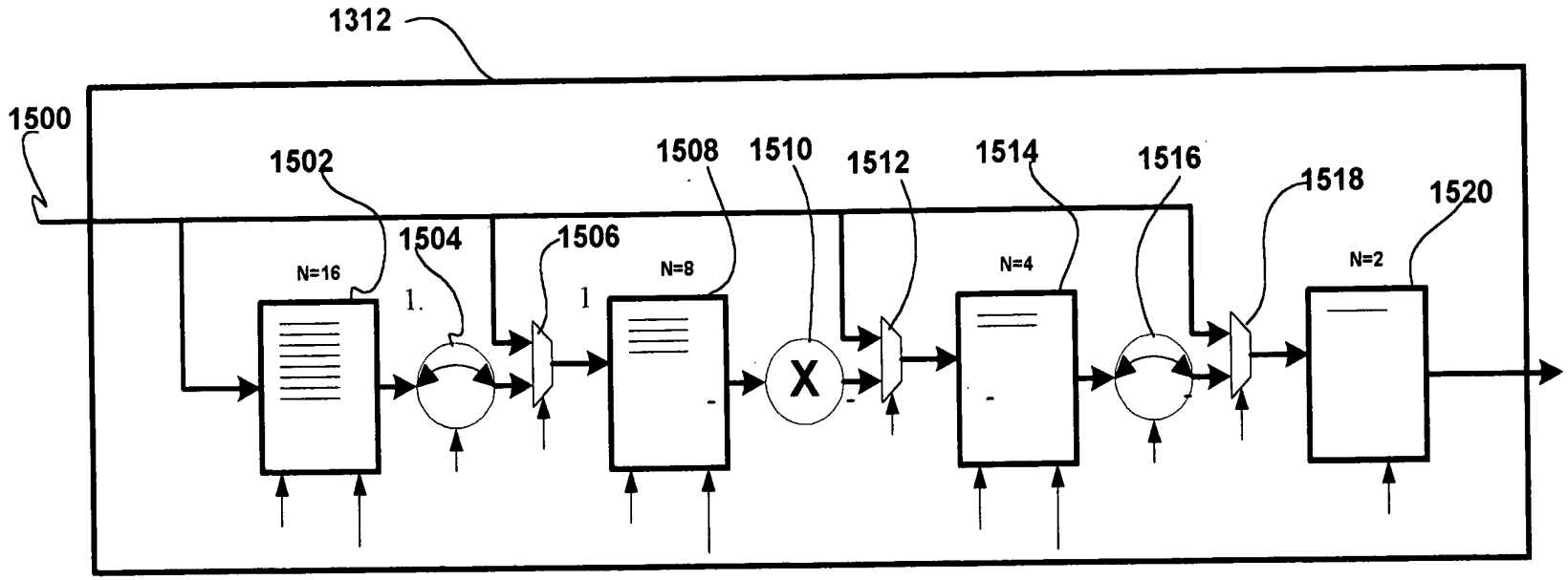

1312
1500
1502
1504
1506
1508
1510
1512
1514
1516
1518
1520
N=16
N=8
N=4
N=2
X

FIG. 15

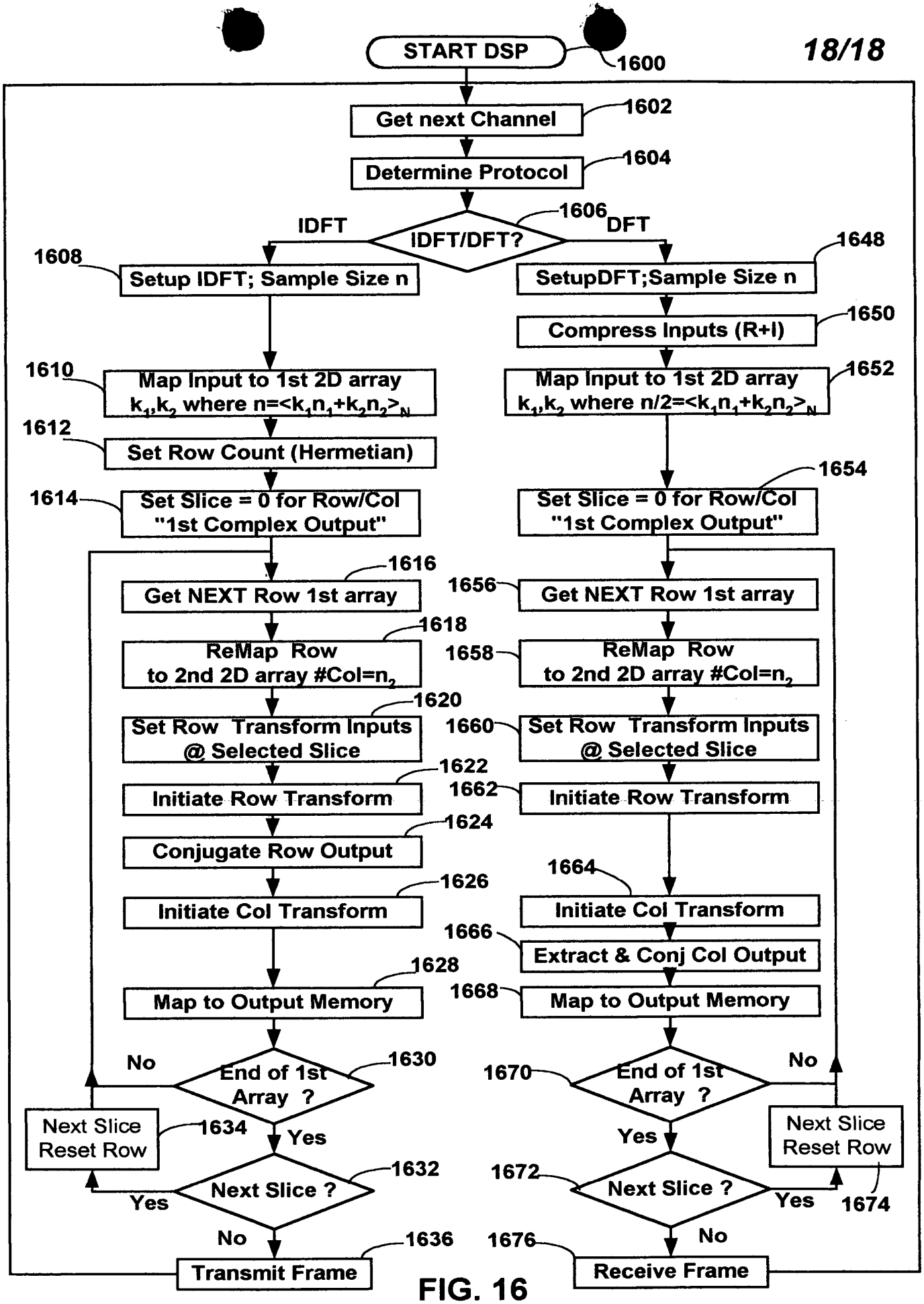

START DSP
1600
Get next Channel
1602
Determine Protocol
1604
IDFT/DFT?
1606
IDFT
DFT
Setup IDFT; Sample Size n
1608
SetupDFT;Sample Size n
1648
Compress Inputs (R+I)
1650
Map Input to 1st 2D array k1,k2 where n=<k1n1+k2n2>N
1610
Map Input to 1st 2D array k1,k2 where n/2=<k1n1+k2n2>N
1652
Set Row Count (Hermetian)
1612
Set Slice = 0 for Row/Col "1st Complex Output"
1614
Set Slice = 0 for Row/Col "1st Complex Output"
1654
Get NEXT Row 1st array
1616
Get NEXT Row 1st array
1656
ReMap Row to 2nd 2D array #Col=n2
1618
ReMap Row to 2nd 2D array #Col=n2
1658
Set Row Transform Inputs @ Selected Slice
1620
Set Row Transform Inputs @ Selected Slice
1660
Initiate Row Transform
1622
Initiate Row Transform
1662
Conjugate Row Output
1624
Initiate Col Transform
1664
Initiate Col Transform
1626
Extract & Conj Col Output
1666
Map to Output Memory
1628
Map to Output Memory
1668
End of 1st Array ?
1630
End of 1st Array ?
1670
No
Yes
Next Slice Reset Row
1634
Next Slice Reset Row
Next Slice ?
1632
Next Slice ?
1672
Yes
No
1674
Transmit Frame
1636
Receive Frame
1676

FIG. 16